Tunable Spin Filter Based on III/V Antimonide Materials.

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Recently, we have proposed a novel tunable split-gate device for spin filters [1]. It is obviously very desirable to use semiconductor material system with large *g*-factors and appropriate electron confinement. III/V compound semiconductors (GaSb, AlSb, InAs and related alloys) with the lattice spacing of 6.1 ∑ are the best choices. InAs and InSb have *g*-factors of –15 and –51, respectively. We therefore expect a very large Zeeman splitting, $\pm g\mu_B B/2$, of the quantized electron energy levels in a quantum well, which will facilitate the demonstration of the proposed tunable spin filter device.

In this presentation, we will summarize our latest on-going research on this newly proposed device. Several samples have been grown by using MBE on GaSb substrates. The typical device structure consists of a 0.1 μm thick GaSb layer, followed by a 0.2 μm AlSb layer, and 0.2 μm thick digital alloy $Al_{0.8}Ga_{0.2}Sb$ as an etch stop layer, and a ten periods 5 nm GaSb/5 nm AlSb superlattice. After these layers, a 30 nm AlSb bottom barrier, a 15 nm InAs quantum well (QW), and a 30 nm top AlSb barrier were grown. The top barrier is δ-doped with Te, 10 nm from the InAs QW. Finally, a 20 nm $AlSb_{0.9}As_{0.1}$ holes barrier layer and a cap layer consisting of 5 nm GaSb and 0.9 InAs were grown.

Currently, we are in the process of making transport measurements and devices. More details will be reported at the workshop.

Reference:

1. M.J. Gilbert, J.P. Bird. Appl. Phys. Lett. **77**, 1050 (2000).